Trawl efficiency device shows promise

by C. A. Oravetz and C. J. Grant

THE NATIONAL Marine Fisheries Service (NMFS), the US counterpart agency to the Australian Fisheries Service, has developed a piece of fishing gear called a Trawling Efficiency Device.

This device, with an acronym of TED, is installed in the rear of a trawl just before the cod end.

Its purpose is to release from the trawl marine organisms such as sea turtles, fish and trash items including horseshoe crabs, jellyballs, large skates or rays, sharks, and even logs and rocks.

The TED was developed after many years or research initially directed toward eliminating the take of sea turtles by prawn trawls.

There are seven species of sea turtles in the world and five occur in waters off the southeast coast of the United States.

A major problem occurred when several of the species were added to the endangered species list in 1978 because of the high incidental take by the prawn fishery.

In fact, all five of the species, the loggerhead *(Caretta caretta)*, Kemp's ridley *(Lepidochelys kempi)*, the green turtle *(Chelonia mydas)*, the hawksbill *(Eretmochelys imbricata)* and the leatherback *(Dermochelys coriacea)* are listed and therefore protected under the United States Endangered Species Act. They are also protected by several international agreements.

The problem is perplexing because shrimp is the most valuable fishery in the United States.

There are about 6,000 large offshore vessels in the US southeast fishery and somewhere between 30,000 and 40,000 smaller boats that fish nearshore waters.

To prevent closing down the fishery or closing specific areas to shrimping when the turtles were listed in 1978, the NMFS promulgated regulations that allowed the incidental take of[1] threatened sea turtles like the loggerhead, the principle species taken incidentally by shrimp trawls.

The NMFS realised that this was only a short-term solution to the problem and a way must be found to allow the shrimp industry to continue with minimum restrictions, but at the same time take every measure possible to conserve these threatened and/or endangered sea turtles.

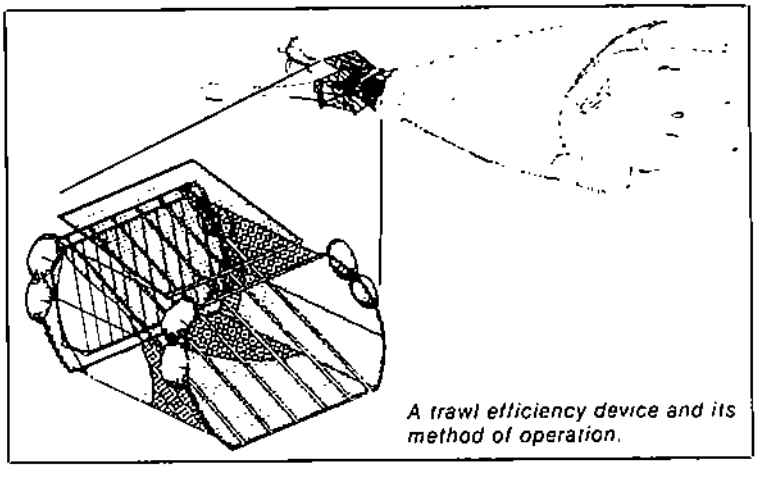
Accordingly, the NMFS initiated research efforts to develop gear that would meet both objectives.

The first innovation was an attempt to prevent sea turtles from entering the trawl by installing what was termed an excluder barrier.

This was a large mesh (25-30 cm) panel of netting that was installed over the mouth of the trawl.

Its function was to allow shrimp to pass through the large meshes and into the trawl, while preventing the entry of larger objects such as sea turtles.

Various configurations of the excluder panel were tested, some sloping upward from the bottom of the trawl mouth to the top, others sloping downward with the



A trawl efficiency device and its method of operation.

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webbing slanting from the top of the trawl mouth to the bottom or lead line.

Both designs were partially successful in preventing turtles from entering the trawl. Reduction in turtle catch rates were near 70 per cent.

Sometimes sea turtles became entangled in the large meshes of the panel; however, a more severe problem with this approach was the loss of shrimp, which ranged between 15 and 30 per cent, an economically unacceptable amount.

After several years of research on panel design, a converse approach was explored; i.e. to release the turtles after they entered the trawl.

This approach was based largely on a gear modification used by American shrimpers for many years, commonly referred to as a jellyball shooter.

The jellyball shooter was a metal hoop with bars installed in the circle.

The hoop was inserted into the back of the trawl before the cod at an angle of about 45 degrees; a slit was cut in the top of the webbing above the shooter so that when heavy concentrations of jellyfish *(Stomolophus meleagris)* commonly referred to as cannonball jellyfish, were encountered on the shrimp grounds, they would be forced out through the slit.

The drawback to jellyball shooters is that a significant number of shrimp is lost, but this loss my be acceptable when contrasted with the alternatives of not fishing, or tearing nets, or even losing gear from nets loading with tremendous amounts of jellyballs.

The NMFS adapted the basic concept of the jellyball shooter in constructing the TED.

The first TED consisted of two semi-oval metal rings connected by a few lateral bars and several diagonal bars. It was 107 cm wide, 90 cm high, and 90 cm long.

The diagonal bars were spaced 15 cms apart to allow shrimp to pass through.

This large cage-like device was named to match its objective and called the Turtle Excluder Device.

The NMFS experimented with several configurations of this TED, including models with the diagonal bars slanting from the top of the first ring to the bottom of the second ring, and with bars slanting from the bottom of the first ring to the top of the second ring; the latter configuration worked best.

Turtle catch reduction rates of almost 100 per cent were achieved with this 'original TED'.

It was also demonstrated that there was no reduction in shrimp catches. In many cases, there was actually a slight increase in the catch of shrimp.

The Fisheries Service now had a device that achieved the dual objective — it would save sea turtles and not lose shrimp.

However, because of severe economic problems in the shrimp industry, including competition from imported shrimp, declining catches per vessel, the inability of many shrimpers to secure insurance, and loss of access to foreign fishing grounds, the Government did not favor regulating the use of the TED.

Instead, the Government embarked on a program in 1981 to encourage the voluntary use of the TED.

The initial step in the voluntary TED Technology Transfer program was the construction of 100 TEDs.

They were built under government contract by a major trawler manufacturer in St Augustine, Florida, and distributed free to selected shrimp fishermen in the southeast, with particular emphasis in the south Atlantic area where the mortality of loggerhead turtles was much higher than in other parts of the country.

The loggerhead mortality problem is more prominent in that area because the coastline is mostly sand beach, and many dead sea turtles wash up on the beaches each summer.

In the summer of 1980, for instance, more than 2,000 dead sea turtles were recorded on US south Atlantic beaches, and many of the deaths were attributed to shrimping.

The NMFS placed observers aboard shrimp trawlers to determine the actual incidental catch and mortality of sea turtles.

From observer data collected in 1979, 1980, and 1981, the Fisheries Service estimated that the incidental catch of all sea turtle species by the US shrimp fishery is slightly over 45,000 a year.

The data also indicated that annually about 12,600 sea turtles die as a result of shrimping activities.

The initial reaction of the shrimp fishermen who received the first 100 TEDs was less than enthusiastic.

They complained that the TED was too cumbersome and too dangerous to use, especially in rough seas.

Their objections were probably well-founded in that the original TED was a 100 cm cage-like cube that weighed 44 kg.

On smaller vessels, those 15 m or less, there was certainly a problem with limited deck space, even though the TEDs were only stored on deck prior to and at the end of the fishing day.

There was a definite reluctance by many fishermen to use them.

In an attempt to overcome objections to the TED, the size was reduced. A second contract was issued to construct additional, but smaller TEDs.

The first TEDs had a front hoop opening that was larger than the rear opening because it was assumed that a funnel-type configuration would force the turtles through the front opening, cause them to strike the diagonal bars and be released through the trap door in the top of the TED.

Size data on captured turtles was analysed and it was determined that the front hoop could be reduced to the same size as the back hoop.

Ninety-six of these TEDs were manufactured under government contract and again selectively distributed to shrimp fishermen, primarily in the south Atlantic area, but with some limited distribution in the Gulf of Mexico.

Some fishermen liked this TED a little better than they did the first model, but there were still many complaints that the TED was too big, too bulky, and difficult to use.

It also became more evident that the fishing industry would not use the TED voluntarily simply to save an endangered species. There were too few benefits, economically or otherwise.

The only real benefit was elimination of the jellyballs and other trash, and the jellyball problem still occurred sporadically.

In many cases, the fishermen who received the TEDs used them only for short periods when jellyballs were abundant.

In the meantime, the Fisheries Service continued to experiment with the TED to increase benefits and at the same time make it more attractive to fishermen.

NMFS next tackled the problem of incidental catch of finfish that occurs in many areas of the US southeast, particularly in the Gulf of Mexico.

At certain times of the year, usually the summer, large bycatches of fish, such as croaker *(Micropogonias undulatus)*, cutlassfish *(Trichiurus lepturus)*, Atlantic bumper *(Chloroscombrus chrysurus)*, catfish *(Arius felis)*, spot *(Leiostomus xanthurus)* and sea trouts *(Cynoscion)*, are a major problem to shrimp fishermen.

The first approach tried was the addition of holes in the side webbing around the TED.

This modification achieved a reduction of 50 per cent of the finfish bycatch in the daytime, but when tested at night the TED only reduced the finfish bycatch by 10 per cent.

The majority of shrimping in the United States, particularly in the Gulf of Mexico, is done at night, so a significant problem remained.

Continued experimentation by the NMFS involved the installation of a barrier device called a pinger, or fish separator, into the back end of the TED.

This was an oval hoop with wires stretched vertically; the wires were spaced 5 cm to 7 cm apart.

Its purpose was to prevent finfish from entering the back of the trawl by deflecting or guiding them to the side where they could escape through holes in the webbing.

This new feature reduced finfish catch rates markedly.

The best finfish catch reduction rates so far have been 70 per cent in the daytime and from 51 to 53 per cent at night.

This, combined with a 44 per cent reduction in the elimination of other trash, offered major advantages to the shrimp industry.

However, there were still complaints about the size and weight of the TED, so attempts were made to lighten the TED and make it easier to use.

The NMFS experimented with collapsible TEDs and evaluated other types of construction materials. Various plastics and fibreglass were tried and there was finally a TED made of fibreglass that performed extremely well.

The problem encountered was the fibreglass rod was not readily available at a reasonable cost for mass production of the TED. There were also problems with weak joints in the fibreglass TED.

These difficulties caused researchers to revert to the collapsible, galvanised pipe TED that weighted slightly more than the fibreglass model but was still a significant improvement over earlier designs.

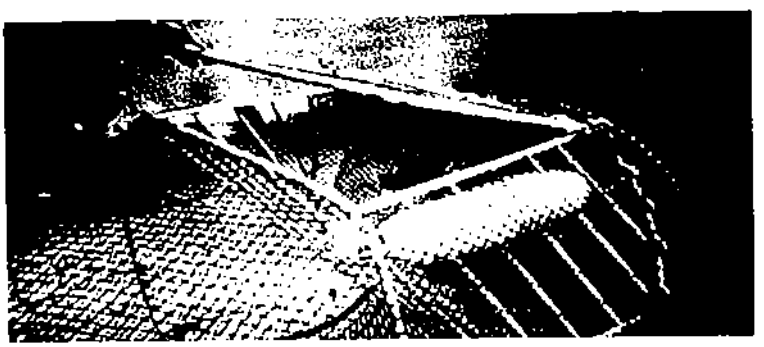
The latest design weighs 17 kg, is fully collapsible (folds flat on deck) substantially reduces the catch of sea turtles, reduces finfish bycatch, eliminates trash, and does not reduce the shrimp catch.

Throughout the TED testing and technology transfer program, the Fisheries Service received complaints not only from shrimp fishermen who disliked the TED, but also from the environmental community that wanted use of the TED to be mandatory.

The NMFS attempted to resolve this conflict by establishing an advisory committee composed of five major shrimp industry leaders and five representatives of five of the most outspoken conservation groups for sea turtles.

A third element of the committee was a representative of the Sea Grant Marine Advisory program. Sea Grant is the United States government agency responsible for marine extension activities. The Fisheries Service relies heavily on Sea Grant marine extension agents to publicise the TED and encourage its use.

The purpose of the TED Advisory Committee is to advise the Fisheries Service in its TED technology transfer program and



A diver checks TED during early trials.

also to keep diverse interest groups working together to solve a common problem.

Despite program efforts of free TEDs, workshops, demonstrations, publicity, and an outside advisory body, progress toward adopting the TED has been slow.

The Fisheries Service estimates between 200 and 300 US trawlers are now using the TED.

To some, this is not significant progress considering the 6,000 + offshore vessels in the shrimp fishery, and the 30,000 or 40,000 smaller nearshore vessels.

Others accept the adoption rate, realising the latest model collapsible TED with fish excluder has been available only since the summer of 1985.

The Fisheries Service continued the selective distribution of the new model TED in the summer of 1985, building and distributing 50 collapsible TEDs.

A former shrimper, thought to be more acceptable to shrimpers, was employed by NMFS as a gear specialist to distribute TEDs. He installs TEDs on shrimp vessels and fishes them for two or three days to ensure that the TED is working properly.

The latest model TEDs have been far more acceptable than all earlier models.

A major problem the Fisheries Service experienced throughout the TED technology transfer program was encouraging the commercial production of TEDs.

TEDs can be constructed and installed for about $400 each. But so far, attempts to achieve widespread commercial manufacture of the TED have been futile.

Some trawl manufacturers have built TEDs but charged $650-$850 per unit. At this cost, TEDs would be an economic burden for shrimpers.

Many shrimpers tow two and in some cases four nets, which would involve expenditures of $3,000 or more.

Without a proven economic return, it's understandable why shrimpers do not immediately accept the TEDs.

Nonetheless, NMFS plans to continue its voluntary approach for some time to afford every possible opportunity for adoption.

A voluntary approach is preferred because regulation of so many vessels in such a widespread geographic area has obvious enforcement problems. NMFS enforcement of a TED regulation would cost an estimated $1 to $1.5 million annually.

TED technology transfer in 1986 will involve more workshops for trawl manufacturers to encourage construction of TEDs, additional publicity, and educational aids for Sea Grant Marine Advisory Agents. The major shrimp trade associations will employ gear specialists to advocate use of the TED.

An offshoot of US TED testing has been the interest generated in foreign countries.

Several countries have inquired about the TED and NMFS has tried to be responsive to these inquiries.

The biggest TED success story from other areas is its use in Indonesia. The Indonesians have joint-venture agreements with Japan that allow shrimping privileges to Japanese vessels provided they use Indonesian crews.

Because of the large bycatch of finfish in this fishery, Indonesia in 1981 was contemplating a shutdown of the fishery. Indonesian fishery scientists visiting the United States at the time were shown a film of the TED. (Copies, on film or video, are available from NMFS.) At-sea demonstrations were also arranged.

The Indonesians liked what they saw so much that they modified their position and allowed the use of TED-equipped trawls by the Japanese fishermen. Over 1,000 TEDs are in use by the Japanese in Indonesia.

Other inquiries have been received from Mexico, Malaysia, India, Netherland Antilles, Panama, Costa Rica, Trinidad and Tobago, Honduras, and Australia. Some of the countries are experimenting with the TED.

In summary, the Fisheries Service of the United States has a significant problem, with its major fishing industry taking a high level of a protected species.

The principle species taken is the loggerhead turtle which is a threatened species. There are no total population estimates of this species available, but the nesting population in the United States is estimated to be in the order of 14,000.

It is not known how long this species can withstand a high incidental take by the shrimp industry.

A more critical problem and one that has the US environmental community gravely concerned, is the take of endangered Kemp's ridley turtles.

The Kemp's ridley nests exclusively on one beach in Mexico about 160 km south of Brownsville, Texas. The primary range is in the Gulf of Mexico, although there have been sightings and recaptures of specimens along the Atlantic seaboard of the United States and in two rare instances on the coast of Europe.

A 1947 film of an arribaba of Kemp's ridley turtles estimated there were 40,000 turtles in that mass nesting aggregation. The population has declined drastically since. In 1985, the estimated nesting population was 550 females.

Even though the Mexican and the United States governments, in a co-operative program, have protected the nesting population of this species for the last 9 or 10 years, the species is still thought to be in a rapid state of decline.

Environmentalists point to the shrimp industry, both in the United States and Mexico, as the major cause in the species' decline.

Therefore, the NMFS continues to aggressively promote use of the TED as a possible solution to the problem.